CHAPTER 3

IT'S JUST A CROP?

Public Perception and Transgenic Trees

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Abstract. Genetic modification of forest trees has followed similar efforts in agriculture. Over 100 years ago, those conducting purposeful forest management in the United States have engaged terminology from Europe that was naturally adapted from agricultural pursuits. Early conservationists used such phrases as "trees are a crop" to help the American public understand that forests deserved their investment. Later, the same language was used and continues to be used to justify active management in the face of environmental pressures. Public perception of genetically modified trees is connected in this basic way to transgenics in agriculture and this increases the challenge to understanding the driving forces of public opinion. This paper traces this historic connection and suggests that public discourse will be a vital part of the process that decides how quickly and under what conditions transgenic forest trees are used.

1. INTRODUCTION

Until very recently, trees were genetically improved through conventional breeding techniques, in much the same way as livestock are bred to produce certain desirable characteristics in their offspring. Molecular domestication has arrived with advances in science and technology and the issue of genetic engineering is front and center in forest management. Part of the issue is that the general public has little knowledge about genetic engineering. However, the result of one study suggests that providing more public education alone about genetic modification will not necessarily lead to acceptance. The relationship between levels of support for genetically modified food, for instance, and objectively measured knowledge is weak at best and there may be little difference in knowledge between supporters and opponents (HALLMAN 1995). It may be unlikely that one can simply "educate people into acceptance" (HALLMAN AND ALQUINO 1993). Potential consumers must be viewed as taxpayers and citizens who will deliberate about use of this technology and if "perception is reality" then producers and policymakers must also concern themselves with public perception.

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2. PUBLIC PERCEPTION AND TRANSGENIC TREES

Public perception of the science and social aspects of landscapes, genomics, and transgenics in forests seems to be inextricably linked with our perceptions of transgenics in agriculture; from the killer tomato, to Dolly the sheep, to finding genetically manipulated corn intended for animal feed in corn supplies for human consumption. On the surface, we can assume that fears in one arena can influence and lead to fears in another. But how might our dialogue in the past about forests and agriculture affect our debates today? While scientists face the challenge of discussing how transgenics in forests may differ from agriculture, our past language suggests that differentiation will be complex.

It is not hard at all to see that there is a natural and undeniable connection between the concepts of forestry and agriculture. Trees grow from seed, trees can be planted, they can be tended, we employ site preparation and weed control, it is periodically harvested, and then the process can begin again. If someone wanted to put forth a justification for treating forests as something to be managed, as something that is best rigorously controlled, then what better analogy than an agricultural field. As well, the historical labors to move plants (and their genomes) across large distances and fledging tree improvement approaches were born out of early agricultural and horticultural efforts. The beginnings of plant husbandry in North America began in earnest in the Late Archaic period from 3,000 to 1,000 B.C. (YARNELL 1998). In an 1882 book, *Elements of Sylviculture*, G. Bagneris, who was inspector of forests and professor at the forest school of Nancy, France, wrote about reproduction of the forest. He writes "…recourse must be had to artificial means in order to restore the good condition of the forest, or a satisfactory composition of the crops." He said "To exploit a forest or crop means to fell it in accordance with the principles of sylviculture." He defines annual yield as "…the quantity of produce that can be taken out of a forest annually on the condition that this quantity can be maintained at a constant figure" (BAGNERIS 1882).

Less than ten years later, Gifford Pinchot, attended classes at this same school at Nancy France, for less than a year of study that represented his formal training in forestry. The intellectual ancestor of forestry in the United States was exposed in early training to a system of highly regulated forestry. This early use of the term "crop" as it relates to trees continued and it would eventually be used in public relations by the forest industry that previously had abandoned their land instead of paying the taxes. At the American Forest Congress in 1905, F.E. Weyerhaeuser put forth time, fire and taxes as primary obstacles "that must be reckoned with in the profitable production of timber…,"

claiming that it certainly was not "...just that land which can produce but one crop in forty years should be taxed on the same scale as land which produces an annual crop" (WEYERHAEUSER 1905).

The American Forest Congress of 1905 was, in part, conducted to secure political support to transfer the forest reserves from the U.S. Department of the Interior to the U.S. Department of Agriculture. This would bring the foresters and the land they would manage together and it seems probable that this reference to crops assisted Pinchot and President Roosevelt to orchestrate the transfer. In the House of Representatives debate about the transfer, Pinchot wrote that Congressman John F. Lacey of Iowa defined Forestry as "… a great system of tree farming" and that it "…is of vital importance to the farmers of the United States (PINCHOT 1987).

In 1909, Carl Alwin Schenk, founder of the Biltmore forest school in North Carolina, published his book entitled *Forest Protection*. He uses phrases such as "Work towards immediate reforestation after making a clean sweep of the old crop", a reference to clearcutting with obvious agricultural imagery. The language became the norm. In 1929, two professors from Cornell, in their book on *Forestry; A Study of its Origin, Application and Significance* in the United States, wrote that "…like any other crop, timber becomes a partial or total loss if not utilized when mature…". In a 1949 text entitled "*Farm Wood Crops*," the author notes that "…forestry is not a forestry job on farmland; it is a farm job on forest land." A special point is made that "…wood products are interchangeable with clean-tilled crops." Comparisons of trees to crops are provided such as "...rayon from wood is the equivalent of that made from cotton" and that "Coppice, in hardwoods, is produced by clean-cutting; the next crop, like asparagus, originates from sprouts on the stump…" (PRESTON 1949).

It is no wonder that industry would eventually adopt the concept that timber is crop. Early in the 1900s, George Long, Weyerhaeuser's manager for west coast operations was reported to have used the term consistently. In 1938 the Weyerhaeuser Timber Company made a decision to pay the taxes on some of their cutover lands and allocated $.50 per acre to plant trees among other things. They subsequently took out an ad in the Seattle Post-Intelligencer – "Timber is a Crop." In 1941, the Tree Farm program was launched marking industry's formal commitment to purposefully managing their lands. By 1948, "Timber is a Crop" appeared on the front cover of Weyerhaeuser's annual report. Only 18 years later, Weyerhaeuser would continue on this track by announcing their commitment to "high yield forestry," a reference to assisting nature through planting, site preparation, weed control and nutrient amendments. For decades previously, researchers had explored high yield environments for hybrid corn.

Interestingly, we see more about trees growing like crops rather than forests growing like crops. The difference is subtle but not insignificant. In the February 1950 Forest Farmer magazine, the West Virginia Pulp and Paper Company, which later became Westvaco and more recently MeadWestvaco, placed an ad that was entitled "Timber is a Crop." It stated that "Trees don't grow as rapidly as corn or wheat−and they are not harvested as often. But timber is a crop – a crop that will turn idle acres into productive acres."

In this sense most could agree that, yes, timber is a crop. But the reality is that it is not only a crop. Inherently we recognize the difference between forests and crops. We recognize that corn may grow as high as an elephant's eye but we do not visit a corn field to rejuvenate ourselves, we do not visit a wheat field to reconnect with a world not so dominated by humans, and we do not stand in awe of the majestic height of a soybean field. Why? Because forests can represent a place that is beyond human dominance; because trees live past our lifetimes, both past and future; because forests offer varied opportunities for recreation; and because, while agricultural fields also function as ecosystems, we inherently understand that the complexity of the agricultural field ecosystem does not nearly approach the complexity or aesthetic appeal of a forest.

What is true is that both enterprises, farming and forestry, are dominated by economics. Aldo Leopold, perhaps the most abused of all writers in American literature, recognized this. Often quoted and taken out of context more times than not, his writings are used by pundits who wish to substantiate their own personal philosophy. Take for instance, one of his most popular quotes "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." Surely this is an antithesis to the "Timber is a Crop" moniker. But, rarely is this quotation followed by his next sentences…"It of course goes without saying that economic feasibility limits the tether of what can or cannot be done for the land. It always has and always will" (LEOPOLD 1968 pp. 224-225). It is this economic, ecological and social paradox that Leopold consistently identified but yet fell short of presenting a clear framework for reconciliation of competing land uses. Leopold talked of biotic rights and he was a proponent of wilderness. He was also a devote student of history. Above all, though, he counseled managers to pay attention to their effects on the land; what can we learn from our management decisions, both good and bad.

Leopold took exception to the simplicity of the "trees are a crop" approach. In an example of extremes, he generalized about two groups of thought in specialized fields. Group (A), he remarked "…regards the land as soil, and its function as commodity-production;" while Group (B) "regards the land as biota and its function as something broader." He chastised his own field of forestry as being predominately Group (A),

"…quite content to grow trees like cabbages, with cellulose as the basic forest commodity." He thought that Group (B) professionals would see "forestry as fundamentally different than agronomy" and would manage for both biotic and economic concerns. Leopold asserted that the farmer "must modify the biota more radically than the forester or the wildlife manager."

LEOPOLD, along with fellow forester BOB MARSHALL, helped establish the Wilderness Society in 1935. Initially it was considered a group made up of rich easterners and they were partially right. But 20 years later, as the forestry community was concentrating on explaining that timber was a crop, the Wilderness Society had surpassed 5,000 members across the country and the Sierra Club was starting a grass roots set of chapters. Part of the public's perception was no longer focused on how to get industry to invest in long-term management of the land; it was beginning to focus on how forests were managed on both private and public land. A confluence of factors including RACHEL CARSON's *Silent Spring* highlighted the unintended effects of pesticides, increased harvesting of the national forests to meet the public demand for building products, and a growing population having increased time for recreation, among others, contributed to produce an intensified public discernment of environmental consequences of land management and business decisions. This discerning public eye, whether knowledgeable or not, continues today and will certainly cast its stare to biotechnology and genetic engineering. And this is a good thing. When we are arguing about an issue we know the system is working. Scientific authentication is part of the process as well as social acceptability. Grappling with how to build a sustainable human society is an excellent sign of a vibrant democracy.

While industry and foresters may not have had the foresight in the mid twentieth century to keep pace with public opinion, the general trend of management improvements in the United States during the last hundred years has been on a path toward sustainability (FEDKIW 2004). From conservative lumbering, to sustained yield, multiple-use, ecosystem management and sustainable forestry, the progress has been incremental and adaptive. As well, the scientific knowledge gained during the last past century about ecosystems, genetics, biological diversity, global nutrient cycles, climate, and energy is genuinely astounding (FLOYD 2001). Molecular domestication is part of the current wave of new technology that will be integrated into our quest for sustainability.

Some basic arguments for the use of somatic embryogenesis and genetic transformation in forest ecosystems include that (1) it has the potential to provide solutions to providing adequate wood supplies to meet the needs and desires of

tomorrow's human population, (2) by providing these wood needs, we eliminate the need to use substitutes such as various metals, brick, cement, and plastics that require more energy, emit more greenhouse gases, and introduce more toxic materials into the environment over their life cycle, from extraction and manufacture to eventual disposal, and (3) purposeful genetic changes that are intended to increase the productivity and value of forest trees that are planted, grown, and harvested for wood products can keep more land in reserves and wilderness, as well as open space that increases recreational opportunities. But the general public cannot be viewed as merely consumers and the world is more than economics and the free market system. The actual route to sustainability will be political and a result of public deliberation. Merely helping the public to understand that genetically modified trees can improve their standard of living will not educate them into acceptance. The concerns about unintended consequences will require that safeguards and risk management be integrated into the process, and arguably should have already started. If ample evidence doesn't already exist that indicates genetically modified plants used in agriculture can be hard to contain, the current dialogue in the media surely points this out (CLAYTON 2005). With the ability of pollen from trees to travel hundreds if not thousands of miles (KATUL *et al.,* 2006), it is not likely that any safeguards will assuage the segment of the public with greatest angst. As well, the use of genetically engineered trees most likely demands an intensive management approach. This relationship invokes the agriculture-forestry scenarios discussed above.

Ironically, it might be the use of genetic engineering in a horticultural sense that might ease public acceptance to transgenic trees. Already, a genetically modified elm resistant to the Dutch Elm disease, is being outplanted and transgenic plum and papaya are undergoing USDA review. Perhaps the most interesting opportunity is restoration of the American Chestnut to the forests of the eastern United States. The transgenic chestnuts will not be in plantations. The concept is to install them individually or in small plots so that they can regenerate on their own. Those trees will receive intensive management, but it will be far different than for industrial plantations. If successful, this example will help frame, not circumvent, public discourse about molecular domestication in forest trees.

During the last century we have had parallel discourse about forests and trees as they relate to farms and crops. One thread purports that trees are a crop and can be managed intensively to produce public goods. This was a productive analogy while informing

public opinion about a possible timber famine and gaining industrial commitment to purposeful forest management. The other thread, that forests are more than crops, that aesthetics as well as economics will provide the greatest public good, lurked in the shadows and emerged with the second conservation movement in the mid 1900s. Both are relevant today as we continue the public debate about transgenic trees because they both still pervade the public consciousness. We can be sure that the political decisions necessary to use the technology under defined constraints will be enabled when the public perceives that the benefits of genetic engineering in forest trees outweigh the risks. Public perceptions, mutual understanding, debate and discourse will be necessary parts of the process.

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